
Differential equations

Solve the following problems and hand in your solutions. The solutions will be marked.

Differential equations

1. Find the general solutions of the following differential equations:

$$(a) \quad \dot{x} = t^3 - t \qquad (b) \quad \dot{x} + x = 10$$

2. Find the general solutions of the following equations:

$$(a) \quad \ddot{x} - 3x = 0 \qquad (b) \quad \ddot{x} - x = \sin t$$

3. In the theory of option pricing one encounters the equation

$$x^2 f''(x) + ax f'(x) + bf(x) = \alpha x + \beta$$

where $f(x)$ denotes the value of a stock option if the price of the stock is x . We assume that $(a - 1)^2 > 4b$.

- (a) Find the general solution of the associated homogeneous differential equation.
(Hint: $f^h(x) = x^r$)
- (b) Find a particular solution $f^p(x)$ of the differential equation.

Systems of Differential equations

1. Find the general solutions of the following systems:

$$\begin{array}{ll} (a) & (b) \\ \dot{x} = y & \dot{x} = x - 4y \\ \dot{y} = x & \dot{y} = 2x - 5y \end{array}$$

2. Find the general solution of the following (nonautonomous) system:

$$\begin{array}{l} \dot{x} = 2x - 3y \\ \dot{y} = -x + t \end{array}$$